

Preface

Research at IBM, as distinct from the development of specific products, grew out of small activities started in the years after World War II. The early work at the Watson Scientific Computing Laboratory at Columbia University and that in the solid state field conducted in Poughkeepsie constituted two principal points of origin. For roughly a quarter of a century, the age of this journal, a large and organized research activity has existed; it arose from a growing corporate sense of dependence on science and technology. This issue, therefore, presents a welcome opportunity for a historical review of a few of our many themes.

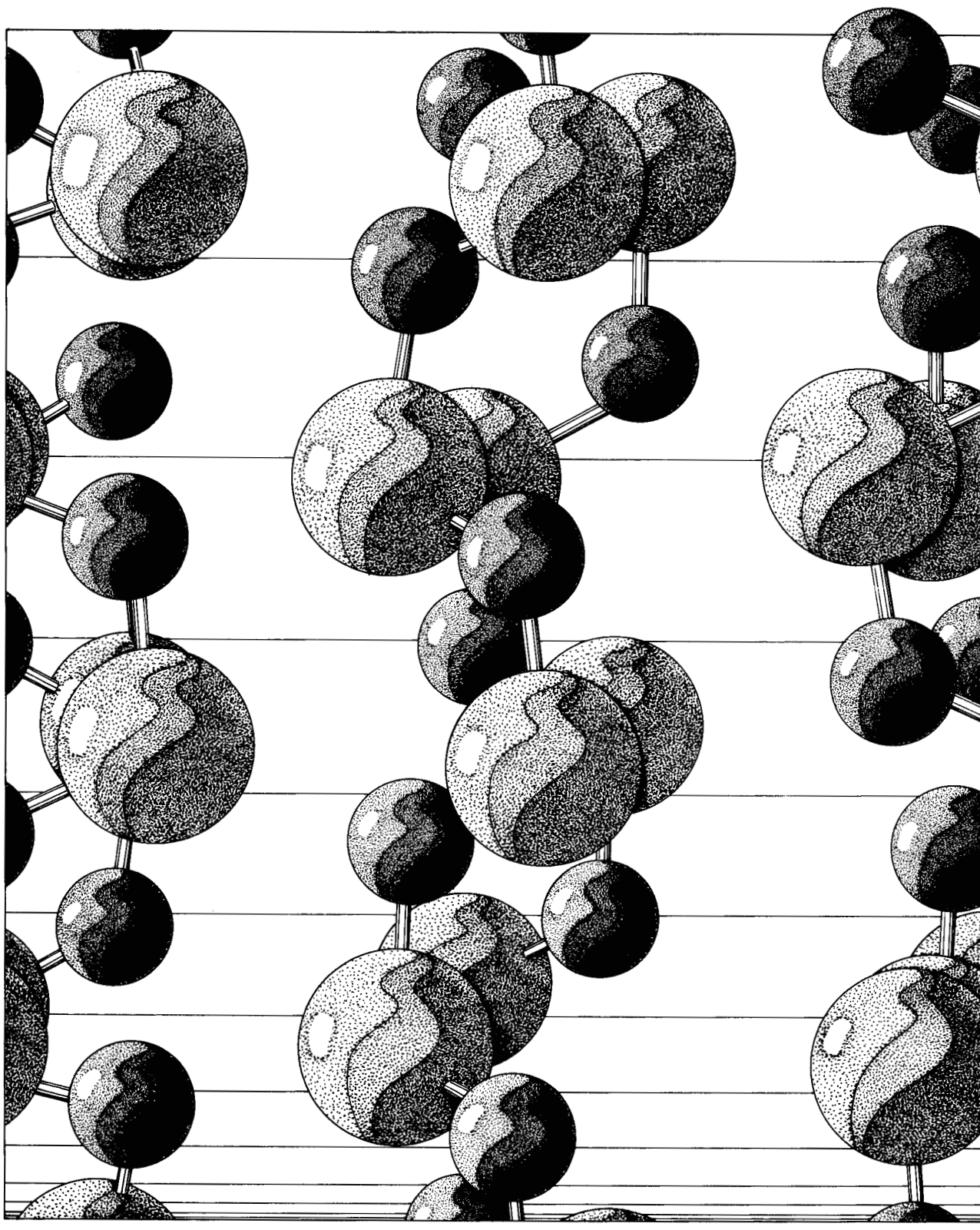
In any effort of this nature and scope, it is necessary to restrict the contents for obvious physical reasons. Thus, this particular chapter seeks to emphasize only some of the more fundamental scientific aspects of IBM's research work over the last quarter century, even though a larger portion of the research activities has clearly been related to areas that are more product-oriented and to technology in general. These latter contributions will be reflected in papers presented in other chapters of this issue. In addition, the many significant contributions of others outside IBM are not discussed although recognition of that work is given in the various papers contained here. The subjects selected for coverage here are some examples of areas in which IBM has undeniably made significant contributions toward furthering basic scientific knowledge. These include semiconductor research, phase transitions, electronic structure, and algebraic complexity theory. Other areas such as computational limits, mathematical programming, nonlinear coherent wave propagation, thin films and their properties, amorphous

solids, surface science, and lasers are not included for reasons associated with limitations of space or because they have been highlighted in past special issues of this journal. For example, laser science and technology (September 1979) and Josephson junction technology (March 1980) have very recently been reviewed in dedicated issues of this journal.

The paper by Bagus and Williams on the theory and computation of electronic structure presented here is from the physical sciences area, but it is also an illustration of work on computer applications. Our interests in scientific computation are long-standing and well established, and they predate the advent of the modern large-scale electronic computer. The paper by Keyes and Nathan stresses our fundamental work in semiconductor research. It deals with such subjects as hot electrons, inversion layers, injection lasers, the Gunn effect, MES-FETs, superlattices, defects, and others. Related pioneering research work more directly applicable to memory and logic technologies is mentioned in papers by Pugh *et al.* and Rymaszewski *et al.* in the chapter on component development and manufacturing technology. Müller and Pytte, discussing phase transitions and related cooperative phenomena, treat a subject relevant to the bistable systems that hold information in our computers. The final contribution to this chapter deals with attempts to understand the limits of the computational process. One aspect, dealing with computational algorithms and their efficiency in terms of elementary steps, is treated by Pippenger.

Editor

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Molecular structure of sulfur nitride